



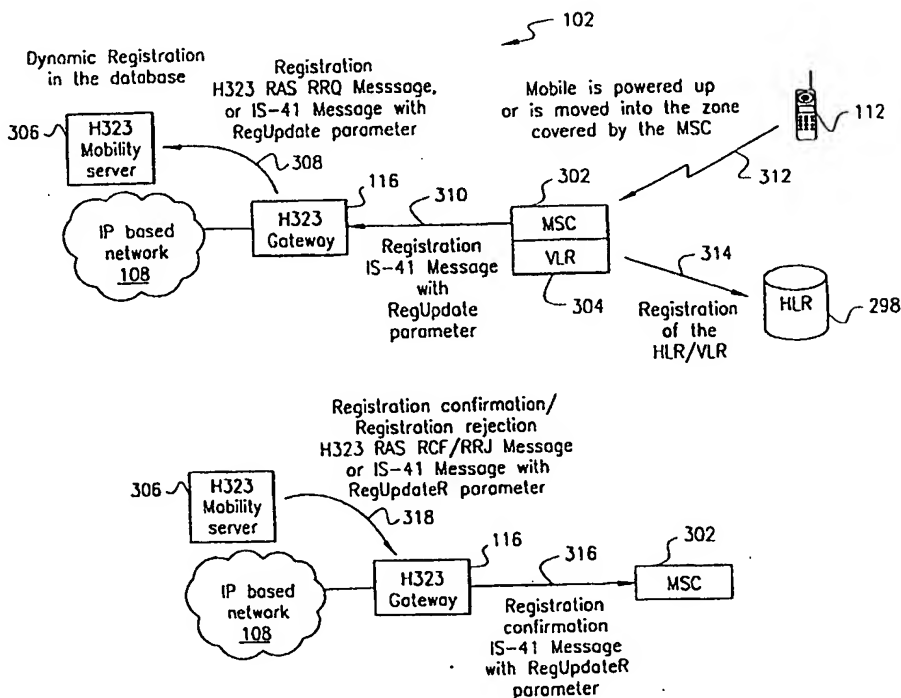
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(54) Title: SYSTEM AND METHOD FOR MOBILE TERMINAL REGISTRATION IN AN INTEGRATED WIRELESS PACKET-SWITCHED NETWORK

(57) Abstract

A system and method of providing a dual registration scheme for a mobile terminal (112) in an integrated wireless telecommunications network (102) having a cellular network portion and a packet-switched network (PSN) portion (108). Upon detecting that the mobile terminal is moved into or powered up in the service area associated with a serving system, the serving system proceeds with the registration of the mobile terminal in the cellular infrastructure. Thereafter, suitable messaging is provided by the serving system via a gateway (116) disposed between the cellular and packet-switched network portions to a mobility server (306) disposed in the PSN for facilitating mobile terminal's registration therein. The mobility server maintains a directory for updating the location information of the mobile terminal pursuant to its registration or unregistration in the PSN. Accordingly, when a mobile terminal receives a call while roaming in a visited service area or located in a home service area, the call is routed using the registration information in the mobility server whereby the need for establishing an inter-MSC trunk is obviated.



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**SYSTEM AND METHOD FOR MOBILE TERMINAL REGISTRATION IN  
AN INTEGRATED WIRELESS PACKET-SWITCHED NETWORK**

**PRIORITY STATEMENT UNDER 35 U.S.C §119(e) & 37 C.F.R. §1.78**

5           This nonprovisional application claims priority based upon the following prior  
U.S. provisional patent application entitled: "System and Method for Providing  
Mobile Stations in a Radio Telecommunications Network with Multimedia Services  
over Packet-Based Networks," Ser. No. 60/110,811 (Attorney Docket Number 1000-  
0136), filed December 3, 1998, in the names of: Hung Tran, Kim Vo, Bartosz  
10 Balazinski, Jean-Francois Bertrand, Laura Hernandez, and Suhail Hasan.

**CROSS-REFERENCE TO RELATED APPLICATIONS**

          This application discloses subject matter related to the subject matter disclosed  
in the following co-assigned patent applications: (1) "System and Method for  
15 Providing Wireless Telephony over a Packet-Switched Network," filed October 26,  
1999, Ser. No. \_\_\_\_\_ (Attorney Docket Number 1000-0144), in the names of:  
Kim Vo, George Foti, Hung Tran, Jean-Francois Bertrand, Bartosz Balazinski, Francis  
Lupien, Zeng-Jun Xiang, and Yang Lu; (2) "System and Method for Providing Mobile  
Switching and Multi-Party Services over a Packet-Switched Network," filed October  
20 26, 1999, Ser. No. \_\_\_\_\_ (Attorney Docket Number 1000-0155), in the names of:  
Hung Tran, Bartosz Balazinski, Jean-Francois Bertrand, and Laura Hernandez; (3)  
"System and Method for Improved Resource Management in an Integrated  
Telecommunications Network Having a Packet-Switched Network Portion and a  
Circuit-Switched Network Portion," filed October 26, 1999, Ser. No. \_\_\_\_\_  
25 (Attorney Docket Number 1000-0156), in the names of: Akilan Tiburtius and Roch  
Glitho.

**BACKGROUND OF THE INVENTION**

Technical Field of the Invention

30           The present invention relates to telecommunication systems and, more

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particularly, to a system and method for registering mobile terminals, or stations, in an integrated wireless packet-switched network such as, for example, a network using the Internet Protocol (IP).

#### Description of Related Art

5 Coupled with the phenomenal growth in popularity of the Internet, there has been a tremendous interest in using packet-switched network (PSN) infrastructures (e.g., those based on IP addressing) as a replacement for the existing circuit-switched network (CSN) infrastructures used in today's telephony. From the network operators' perspective, the inherent traffic aggregation in packet-switched infrastructures allows  
10 for a reduction in the cost of transmission and the infrastructure cost per end-user. Ultimately, such cost reductions enable the network operators to pass on the concomitant cost savings to the end-users. Further, because the need for establishing long distance trunks is eliminated in a PSN, one of the most attractive features of IP-based telephony networks is that charges or tolls for long distance calls, which may be  
15 quite expensive in a CSN, may be advantageously avoided.

IP-based networks designed for providing audio, video, and data communications on a unified foundation are commonly referred to as "Voice-over-IP" (VoIP) networks. Several competing standards or protocols exist today that govern the overall operation, control and service management relating to such VoIP networks.  
20 Some of these standards are: the H.323 Recommendation provided by the International Telecommunications Union (ITU), Session Initiation Protocol (SIP) or Internet Protocol Device Control (IPDC) by the Internet Engineering Task Force (IETF), or the Simple Gateway Control Protocol (SGCP).

In order to be interoperable with the extant Public Switched Telephone  
25 Network (PSTN), current VoIP networks implement communications infrastructures that are primarily oriented to operating with fixed-network-based telecommunications protocols. Consequently, the VoIP protocols designed to accommodate such services as call control, et cetera, for wireline subscribers cannot be used advantageously in wireless environments.

30 Although some VoIP infrastructures may support rudimentary location management services, one of the more nettlesome problems with respect to integrating

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current VoIP networks and harnessing their full potential within the context of a wireless telecommunications network stems from the mobility of cellular subscribers. For example, one of the critical entities defined by the well-known H.323 standard, called a gatekeeper, which provides, among other things, for call routing services and the registration of other H.323-compatible entities within a network, is typically  
5 unaware of conventional telecommunications terminals. While this condition is not a problem for fixed wireline telephones in terms of providing savings in long distance charges, calls involving mobile subscribers may still require establishing long distance trunks from one Mobile Switching Center (MSC) to another. Clearly, those of  
10 ordinary skill in the art should readily appreciate that such a result eradicates one of the primary motivations behind an IP-based telephony network in the first place.

#### SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a system and method for  
15 providing a dual registration scheme for a mobile terminal using an H.323-compatible entity, hereinafter denoted as an H.323 mobility server, provided within a wireless VoIP network. The H.323 mobility server, which in some respects operates as a gatekeeper in accordance with the teachings of the present invention, obviates the need for establishing inter-MSC trunks.

20 In one aspect, the present invention is directed to a method of registering and unregistering a mobile terminal in an integrated wireless packet-switched network system. The integrated wireless packet-switched network system includes a cellular network portion and a packet-switched network portion, wherein the cellular network portion comprises a serving Mobile Switching Center (MSC), a Visitor Location  
25 Register (VLR), and a Home Location Register (HLR). The VLR and the MSC form a serving system for the mobile terminal. The packet-switched network portion preferably comprises a mobility server and a gateway. The method starts by detecting, in the serving system, the mobile terminal located in a service area associated with the serving system. The mobile terminal is then registered in the cellular network portion.  
30 Subsequently, the mobile terminal is also registered in the mobility server of the packet-switched network portion. If the serving system detects that the mobile

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terminal is either being powered down or no longer located in the serving area, the process of unregistering the mobile terminal in the cellular network portion and in the mobility server of the packet-switched network portion is commenced.

5 In another aspect, the present invention is directed to an integrated wireless telecommunications network having a cellular network portion and a packet-switched network portion. A gateway is disposed between the cellular and packet-switched network portions for providing a communication pathway therebetween. The cellular network portion includes means for registering a mobile terminal in a serving system. In addition, the packet-switched network portion includes means for registering the  
10 mobile terminal, responsive to an indication provided by the serving system via the gateway.

In yet another aspect, the present invention's integrated wireless telecommunications network comprises a serving system serving a mobile terminal located in its serving area. A gateway is coupled to the serving system, the gateway  
15 providing a communications pathway between the cellular and packet-switched network (PSN) portions. A mobility server is disposed in the PSN for registering the mobile terminal, the mobility server having means for maintaining location information with respect to a registered mobile terminal. The serving system includes means for sending a private registration message to the gateway to indicate a  
20 registration update with respect to the mobile terminal. The gateway includes means for translating the private registration message into a message compatible with the mobility server and for forwarding the translated message thereto. In another exemplary embodiment, the mobility server may be provided with an interface for interpreting or supporting the private registration message provided by the serving  
25 system. In that case, the gateway does not have to translate the private registration message on behalf of the mobility server, and simply forwards the message thereto.

In a further aspect, the present invention is directed to a method of keeping track of a mobile terminal in an integrated telecommunications network which includes a cellular network portion and an H.323-based PSN portion. The cellular  
30 network portion comprises a serving system for the mobile terminal, which includes a serving MSC and a VLR. The PSN portion includes a gateway that is coupled to the

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serving MSC. The method provides a mobility server in the H.323-based PSN portion, wherein the mobility server contains a registration database. Upon detecting, in the serving system, that the mobile terminal is located in a serving area associated with the serving system, the claimed method registers the mobile terminal in the mobility server of the PSN portion.

5 In a still further aspect, the present invention is directed to a call routing method for routing an in-coming call towards a mobile terminal disposed in an integrated telecommunications network such as the network set forth above. After providing a mobility server for registering the mobile terminal in the PSN portion of the network, the in-coming call is received in a receiving system. The receiving system then queries the mobility server for locating the mobile terminal. Responsive to the querying step, the mobility server returns an address (e.g., an IP address) of the gateway that is associated with the serving system of the mobile terminal, to the receiving system. Thereafter, the in-coming call is routed by the network to the mobile terminal based on the address of the gateway.

## BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present invention may be had by reference to the following Detailed Description when taken in conjunction with the accompanying drawings wherein:

20 FIGS. 1A and 1B depict functional block diagrams of an exemplary embodiment of a registration method for a mobile terminal disposed in an integrated wireless IP (WLIP) network provided in accordance with the teachings of the present invention;

25 FIGS. 2A and 2B depict functional block diagrams of an exemplary embodiment of an unregistration method for a mobile terminal in accordance with the teachings of the present invention; and

FIGS. 3 and 4 illustrate control message pathways for implementing a presently preferred exemplary embodiment of a call setup method usable in the WLIP network of the present invention.

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**DETAILED DESCRIPTION OF EMBODIMENTS**

Since the process of mobile terminal registration is discussed within the context of a H.323-based network, a brief description of the H.323 call routing process is provided below.

5           The H.323 protocol, developed originally to provide multimedia communications services over a packet-based network, presently allows PSTN subscribers to communicate with packet-based network users and vice versa. Three entities are of particular relevance in this context: (a) a gateway which permits the interconnection between the packet-based network and the PSTN; (b) a gatekeeper  
10           used for the routing of the H.323-based calls; and (c) a terminal which provides the users of a packet-based network (e.g., Internet) a device similar to a regular telephone.

          The H.323 protocol allows multiple types of addresses for each user. For example, the following address types are common: (a) an H.323 Alias, corresponding to a symbolic name given to a particular H.323 terminal; (b) a transport address,  
15           corresponding to the IP address of the host where the H.323 terminal is located; and (c) an E.164 number, which is simply a phone number associated with the H.323 terminal. In accordance with the H.323 standard, the gatekeeper supervises all the calls delivered through the IP network, and as part of its functionality, it facilitates the matching of the terminal's E.164 number with the IP address of the host where the  
20           terminal is located. Because the IP addresses are necessary for establishing communication between different hosts on the IP network, all H.323 terminals are required to register with the gatekeeper in order to place and receive calls using their E.164 numbers.

          The H.323 gateway connects a telephone switching center (for example, the  
25           PSTN switching center or a cellular switching center) to the IP network. From the perspective of the H.323 IP network, the H.323 GW preferably covers all the telephone numbers which start with a particular E.164 prefix, and accordingly, when the H.323 GW is registered at the H.323 gatekeeper with its E.164 prefix, the gatekeeper routes calls with that E.164 prefix towards the appropriate telephone switching center. It  
30           should be noted that, typically, both an H.323 terminal and the H.323 GW register or unregister at the gatekeeper when they are powered up or down, respectively.



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In the state-of-the-art VoIP implementations provided for landline telephone connectivity, individual PSTN subscribers cannot, and are not, required to register their terminals at the H.323 gatekeeper. That this is not a problem in the context of a fixed landline telephone network should be readily apparent, because as is well-known, the PSTN terminals are typically always accessed through a unique switching center. However, in the context of a cellular telecommunications network, the subject matter of the present invention, it can be appreciated that the mobility of mobile subscribers from one Mobile Switching Center (MSC) to another poses a significant problem. With the current E.164 prefix routing scheme, when a mobile subscriber roams to another MSC, the calls have to go through the mobile subscriber's home H.323 gateway and then through the home MSC associated with the mobile subscriber. From there, trunks have to be seized to the serving MSC where the mobile subscriber is visiting. Accordingly, as set forth in the Background section of the present patent application, the requirement of establishing inter-MSC trunks defeats the fundamental purpose of using and integrating the IP network in cellular environments.

Referring now to FIGS. 1A and 1B, shown therein is a presently preferred exemplary embodiment of an integrated wireless telecommunications network 102, preferably using IP ("wireless IP" or WLIP), for facilitating the dual registration scheme provided in accordance with the teachings of the present invention. It should be understood by those of ordinary skill in the art that only relevant components of a cellular network portion and a VoIP network portion are depicted herein for illustrative clarity. Accordingly, the WLIP network 102 may include other entities such as, for example, H.323 terminals, a Multipoint Controller Unit (MCU), and additional gateways and gatekeepers.

When a mobile terminal, e.g., MT 112, is powered up and detected (as illustrated by path 312) in the serving area of a serving MSC 302, the serving MSC 302 proceeds with the MT's registration in a Home Location Register (HLR) 298 in a conventional manner via standard ANSI-41 signaling mechanisms (via path 314). Also, the MT 112 is registered at a Visitor Location Register (VLR) 304 associated with the serving MSC 302. As is well-known, the serving MSC 302 and its associated VLR 304 together form the MT's serving system.

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Once the registration process with the cellular network infrastructure is completed, the serving MSC then initiates the registration of the MT with respect to the VoIP network 108. An ANSI-41 private message is provided in accordance herewith for the purpose of IP-network registration. The ANSI-41 private message for  
5 IP-network registration, including a parameter called *RegUpdate*, is transmitted by the serving MSC 302 via path 310 to an H.323 GW 116 associated therewith. The *RegUpdate* parameter preferably contains the MT's registration information.

Upon receiving the ANSI-41 private message, the GW 116 translates the information therein into an H.323 *Registration Access and Status (RAS)* message  
10 called *Registration Request (RRQ)*, which is transmitted via path 308 to a H.323 mobility server 306. The *RegUpdate* parameter contained in the *RAS RRQ* message is used by the mobility server 306 for the purpose of the MT's registration in a database associated therewith. Upon successful registration at the mobility server 306, a *Registration Confirm (RAS RCF)* message is returned to the GW 116. On the other  
15 hand, if the registration at the mobility server 306 was unsuccessful, a *Registration Reject (RAS RRJ)* message is returned. The return message path from the mobility server 306 is labeled with reference numeral 318 in FIG. 1B. Consequently, upon receiving the return message from the mobility server 306, the GW 116 sends an ANSI-41 return message via path 316, which includes a *RegUpdate Return Result*, to  
20 the serving MSC 302. It should be understood that the *RegUpdate Return Result* contains an appropriate parameter corresponding to the H.323 answer (i.e., the *RCF* or *RRJ* message).

FIGS. 2A and 2B depict a presently preferred exemplary embodiment of an unregistration process for a mobile terminal that is registered at the mobility server 306  
25 in accordance herewith. When the MT 112 is powered down or detected to be moving out of the serving area of the serving MSC 302, standard ANSI-41 signaling is used via path 404 for informing the HLR 298 about the MT's unregistration at the cellular infrastructures. Similarly, the VLR 304 may be conventionally notified of the MT's location update information. Once again, the unregistration process at the IP-network  
30 108 is facilitated by sending an ANSI-41 private message containing the *RegUpdate* parameter from the MSC 302 to the GW 116. The message path 406 in FIG. 2A

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illustrates this ANSI-41 private message for unregistration.

Upon receiving the ANSI-41 private message for unregistration, the GW 116 may translate the information therein into a suitable H.323 *RAS Unregistration Request (RAS URQ)* message which is sent via path 408 to the mobility server 306. In a manner similar to the registration process described above, the mobility server 306 processes the parametric information appropriately and updates its location database/directory, if necessary (i.e., the entry relating to the departing MT is deleted). Thereafter, it sends an appropriate return message, either a *RAS Unregistration Confirm (RAS UCF)* or a *RAS Unregistration Reject (RAS URJ)*, to the GW 116. A suitable ANSI-41 response message is then forwarded from the GW 116 to the serving MSC 302. In FIG. 1B, these return/response messages are labeled as paths 410 and 412, respectively.

In the presently preferred exemplary embodiment, the *RegUpdate* parameter in the ANSI-41 private message for dual registration comprises a 50-octet structure. The encoding of some of the relevant octets is provided as follows. Octets 1 and 2 are used for the sending individual's information. Octets 9-14 encode the MT's E.164 number. Electronic Serial Number (ESN) of the MT is encoded in octets 15-18. The Location Area Code values are provided in octets 19-20. Registration Type and Capability Report Indicator values are encoded in octets 43-44.

The *RegUpdate Return Result* parameter is presently provided as a 10-octet structure. Octets 7-8 are encoded with the registration result, and octets 9 and 10 are encoded with Capability Report Status information.

It is contemplated herein that the translation of the ANSI-41 private messages into *RAS* messages may be provided as optional, if the mobility server 306 is supported with an ANSI-41 interface. In that case, there is no need for the translated *RRQ/RCF/RRJ* and *URQ/UCF/URJ* messages between the GW 116 and the mobility server 306. Instead, the GW 116 may simply forward the ANSI-41 private messages to the mobility server 306 for registration/unregistration.

As explained in the foregoing, in accordance with teachings herein, the mobility server 306 preferably acts as a H.323 gatekeeper or as a location server within the IP network 108. Accordingly, when a particular gatekeeper in the IP network 108

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does not know the called party's location (that is, its database does not have a E.164 ~~transport~~ address translation for the called number), it inquires through suitable H.225 messages (namely, the *Location Request*, *Location Confirm* and *Location Reject* (*LRQ/LCF/LRJ*) messages) sent to its neighborhood gatekeepers and the mobility server 306 about the location of the called party. The mobility server 306 then responds with the transport address of the GW in its *LCF* return message. Preferably, the database of the mobility server may keep track of multiple registrations of mobile terminals in a manner similar to the location registration process of a VLR. In addition, the mobility server's database preferably uses the E.164 number as a key for its internal database or location directory purposes.

Based on the foregoing, it can be realized that by registering at the mobility server in accordance herewith, the need for establishing inter-MSC trunks when the MT is roaming outside its home location is obviated because the mobility server updates its location directory with the corresponding gateway's address when the MT moves into a new serving area. Accordingly, no long distance toll charges may be necessary by ensuring that the call is transported over the IP network portion.

Referring now to FIGS. 3 and 4, depicted therein are control message pathways for implementing a call setup method for an MT that is registered at the mobility server 306 in accordance herewith. More particularly, FIG. 3 depicts a control message pathway for a call scenario wherein the call is originated by an MT 112. When a call intended for an H.323 terminal 284 is initiated by the MT 112 (path 508), the serving MSC 302 sends an appropriate ANSI-41 or a Primary Rate Interface (PRI) setup message 510 to the GW 116. In response thereto, the GW 116 sends an *Admission Request (ARQ)* message 512 to the H.323 gatekeeper 278. An *LRQ* message 514 is generated by the gatekeeper in order to query the mobility server 306 for the address of the H.323 terminal 284. Subsequently, an *LCF* message 516, is returned from the mobility server 306 with the appropriate location information to the gatekeeper 278, which then sends its own *Admission Confirm (ACF)* message 518 to the GW 116. A Q.931 interface 520 is then set up between the GW 116 and the H.323 terminal 284 which in turn negotiates for *Admission Request* with the gatekeeper 278 via path 522. After a location inquiry process (also referred to as "Endpoint

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Location”) similar to the process described above, the H.323 terminal 284 receives an *ACF* return message 528 from the gatekeeper 278. Thereafter, a call path 530 from the MT 112 to the terminal 284 is established such that the call can proceed therefrom.

FIG. 4 illustrates the call scenario wherein the MT 112 is the called party and the H.323 terminal 284 is the caller. It should be apparent that the control messages shown herein are similar to those illustrated in the description set forth above. Analogous to the situation where the MT is the caller, the mobility server 306 is engaged in a two-stage inquiry process, first with the gatekeeper 278 (upon call origination) and then with the GW 116 (for cellular connectivity). Once the ANSI-41 or PRI setup is effectuated between the GW 116 and the MT 112 via the serving MSC 302, the call path 624 is established between the parties.

Although the system and method of the present invention have been described in particular reference to the H.323 protocol and ANSI-41 standards, it should be realized upon reference hereto that the innovative teachings contained herein are not necessarily limited thereto and may be implemented advantageously with any applicable packet-switching protocols and radio telecommunications standards.

Further, it is believed that the operation and construction of the various aspects of the present invention will be apparent from the foregoing description. While the methods and systems shown and described have been characterized as being preferred, it will be readily apparent that various changes and modifications could be made therein without departing from the scope of the present invention as set forth in the following claims.

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**WHAT IS CLAIMED IS:**

1. A method of registering and unregistering a mobile terminal in an integrated wireless packet-switched network system which includes a cellular network portion and a packet-switched network portion, the cellular network portion comprising a serving Mobile Switching Center (MSC), a Visitor Location Register (VLR), and a Home Location Register (HLR), wherein the VLR and the MSC form a serving system for the mobile terminal, and the packet-switched network portion comprising a mobility server and a gateway, the method comprising the steps of:
  - detecting, in the serving system, the mobile terminal located in a service area associated with the serving system;
  - registering the mobile terminal in the cellular network portion;
  - registering the mobile terminal in the mobility server of the packet-switched network portion; and
  - detecting, in the serving system, that the mobile terminal is no longer active in the serving area; and
  - unregistering the mobile terminal in the cellular network portion and in the mobility server of the packet-switched network portion, upon detecting that the mobile terminal is no longer active in the serving area.
2. The method of registering and unregistering a mobile terminal as set forth in claim 1, wherein the step of registering the mobile terminal in the mobility server of the packet-switched network portion comprises the steps of:
  - sending an ANSI-41 private message by the serving system to the gateway, wherein the private message includes a RegUpdate parameter; and
  - forwarding the ANSI-41 private message by the gateway to the mobility server.
3. The method of registering and unregistering a mobile terminal as set forth in claim 1, wherein the step of registering the mobile terminal in the mobility server of the packet-switched network portion comprises the steps of:
  - sending an ANSI-41 private message by the serving system to the

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gateway, wherein the private message includes a RegUpdate parameter;  
translating the private message by the gateway into an H.323  
Registration Request message; and  
transmitting the H.323 Registration Request message by the gateway  
5 to the mobility server.

4. The method of registering and unregistering a mobile terminal as set  
forth in claim 3, further comprising the steps of:  
sending an H.323 Registration Confirm message by the mobility server  
10 to the gateway, if the mobile terminal's registration thereat is successful; and  
otherwise, sending an H.323 Registration Reject message by the  
mobility server to the gateway.

5. The method of registering and unregistering a mobile terminal as set  
15 forth in claim 1, wherein the step of unregistering the mobile terminal in the mobility  
server of the packet-switched network portion comprises the steps of:  
sending an ANSI-41 private message by the serving system to the  
gateway, wherein the private message includes a RegUpdate parameter;  
translating the private message by the gateway into an H.323  
20 Unregistration Request message; and  
transmitting the H.323 Unregistration Request message by the gateway  
to the mobility server.

6. The method of registering and unregistering a mobile terminal as set  
25 forth in claim 5, further comprising the steps of:  
sending an H.323 Unregistration Confirm message by the mobility  
server to the gateway, if the mobile terminal's unregistration thereat is successful; and  
otherwise, sending an H.323 Unregistration Reject message by the  
mobility server to the gateway.

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7. An integrated wireless telecommunications network having a cellular

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network portion and a packet-switched network (PSN) portion, comprising:

a serving system serving a mobile terminal located in its serving area, the serving system forming a part of the cellular network portion of the network;

5 a gateway coupled to the serving system, the gateway providing a communications pathway between the cellular network portion and the PSN portion;

a mobility server disposed in the PSN for registering the mobile terminal, the mobility server having means for maintaining location information with respect to a registered mobile terminal;

10 means in the serving system for sending a private registration message to the gateway to indicate a registration update with respect to the mobile terminal; and

means in the gateway for translating the private registration message into a message compatible with the mobility server and for forwarding the translated message thereto.

15 8. The integrated wireless telecommunications network as set forth in claim 7, further including a gatekeeper for providing address translation and one or more terminals disposed in the PSN.

20 9. The integrated wireless telecommunications network as set forth in claim 7, wherein the registration update includes an indication that the mobile terminal is no longer active in the service area of the serving system.

25 10. The integrated wireless telecommunications network as set forth in claim 7, wherein the registration update includes an indication that the mobile terminal is just powered up in the service area of the serving system.

30 11. The integrated wireless telecommunications network as set forth in claim 7, wherein the registration update includes an indication that the mobile terminal has just moved into the service area of the serving system.

12. The integrated wireless telecommunications network as set forth in



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claim 7, wherein the registration update includes an indication that the mobile terminal has just moved out of the service area of the serving system.

13. An integrated wireless telecommunications network having a cellular network portion and a packet-switched network (PSN) portion, comprising:
- 5 a serving system serving a mobile terminal located in its serving area, the serving system forming a part of the cellular network portion of the network;
- a gateway coupled to the serving system, the gateway providing a communications pathway between the cellular network portion and the PSN portion;
- 10 a mobility server disposed in the PSN for registering the mobile terminal, the mobility server having means for maintaining location information with respect to a registered mobile terminal;
- means in the serving system for sending a private registration message to the gateway to indicate a registration update with respect to the mobile terminal; and
- 15 means in the gateway for forwarding the private registration message to the mobility server, wherein the mobility server includes means for interpreting the private registration message originated by the serving system.

14. The integrated wireless telecommunications network as set forth in claim 13, further including a gatekeeper for providing address translation and one or more terminals disposed in the PSN.
- 20

15. The integrated wireless telecommunications network as set forth in claim 13, wherein the registration update includes an indication that the mobile terminal is no longer active in the service area of the serving system.
- 25

16. The integrated wireless telecommunications network as set forth in claim 13, wherein the registration update includes an indication that the mobile terminal is just powered up in the service area of the serving system.
- 30

17. The integrated wireless telecommunications network as set forth in

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claim 13, wherein the registration update includes an indication that the mobile terminal has just moved into the service area of the serving system.

5           18.     The integrated wireless telecommunications network as set forth in claim 13, wherein the registration update includes an indication that the mobile terminal has just moved out of the service area of the serving system.

          19.     An integrated wireless telecommunications network having a cellular network portion and a packet-switched network portion, comprising:  
10                 a gateway disposed between the cellular and packet-switched network portions providing a communication pathway therebetween;  
                  means in the cellular network portion for registering a mobile terminal in a serving system; and  
                  means in the packet-switched network portion for registering the  
15     mobile terminal, responsive to an indication provided by the serving system via the gateway.

          20.     The integrated wireless telecommunications network as set forth in claim 19, wherein the gateway includes means for interpreting the indication provided  
20     by the serving system on behalf of the means in the packet-switched network portion for registering the mobile terminal.

          21.     A method of keeping track of a mobile terminal in an integrated telecommunication network which includes a cellular network portion and an H.323-  
25     based packet-switched network portion, the cellular network portion comprising a serving Mobile Switching Center (MSC), a Visitor Location Register (VLR), and a Home Location Register (HLR), wherein the VLR and the MSC form a serving system for the mobile terminal, and the packet-switched network portion comprising a gateway coupled to the serving MSC, the method comprising the steps of:  
30                 providing a mobility server in the H.323-based packet-switched network portion, the mobility server containing a registration database;

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detecting, in the serving system, the mobile terminal located in a service area associated with the serving system; and

registering the mobile terminal in the mobility server of the packet-switched network portion.

5

22. The method as set forth in claim 21, further comprising the steps of:

detecting, in the serving system, that the mobile terminal is no longer active in the serving area; and

unregistering the mobile terminal in the mobility server of the packet-switched network portion, upon detecting that the mobile terminal is no longer active in the serving area.

10

23. The method as set forth in claim 21, wherein the step of registering the mobile terminal in the mobility server of the packet-switched network portion comprises the steps of:

15

sending an ANSI-41 private message by the serving system to the gateway, wherein the private message includes a RegUpdate parameter; and

forwarding the ANSI-41 private message by the gateway to the mobility server.

20

24. The method as set forth in claim 21, wherein the step of registering the mobile terminal in the mobility server of the packet-switched network portion comprises the steps of:

sending an ANSI-41 private message by the serving system to the gateway, wherein the private message includes a RegUpdate parameter;

25

translating the private message by the gateway into an H.323 Registration Request message; and

transmitting the H.323 Registration Request message by the gateway to the mobility server.

30

25. The method as set forth in claim 21, further comprising the step of:

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registering the mobile terminal in the cellular network portion of the integrated telecommunications network.

- 5           26.     The method as set forth in claim 25, further comprising the steps of:  
determining if the mobile terminal is no longer active in the serving area of the serving MSC; and  
if so, unregistering the mobile terminal in the cellular network portion.

- 10           27.     A call routing method to route an in-coming call towards a mobile terminal in an integrated telecommunication network which includes a cellular network portion and an H.323-based packet-switched network portion, the cellular network portion comprising a serving Mobile Switching Center (MSC), a Visitor Location Register (VLR), and a Home Location Register (HLR), wherein the VLR and the MSC form a serving system for the mobile terminal, and the packet-switched  
15     network portion comprising a gateway coupled to the serving MSC, the method comprising the steps of:

providing a mobility server in the H.323-based packet-switched network portion, the mobility server containing a registration database;

- 20           detecting, in the serving system, the mobile terminal located in a service area associated with the serving system;

registering the mobile terminal in the mobility server of the packet-switched network portion;

receiving the in-coming call in a receiving system of the integrated telecommunications network;

- 25           querying, by the receiving system, the mobility server for locating the mobile terminal;

responsive to the querying step, sending by the mobility server an address of the gateway associated with the serving system of the mobile terminal to the receiving system; and

- 30           upon receiving the address from the mobility server, routing the in-coming call to the mobile terminal based on the address.

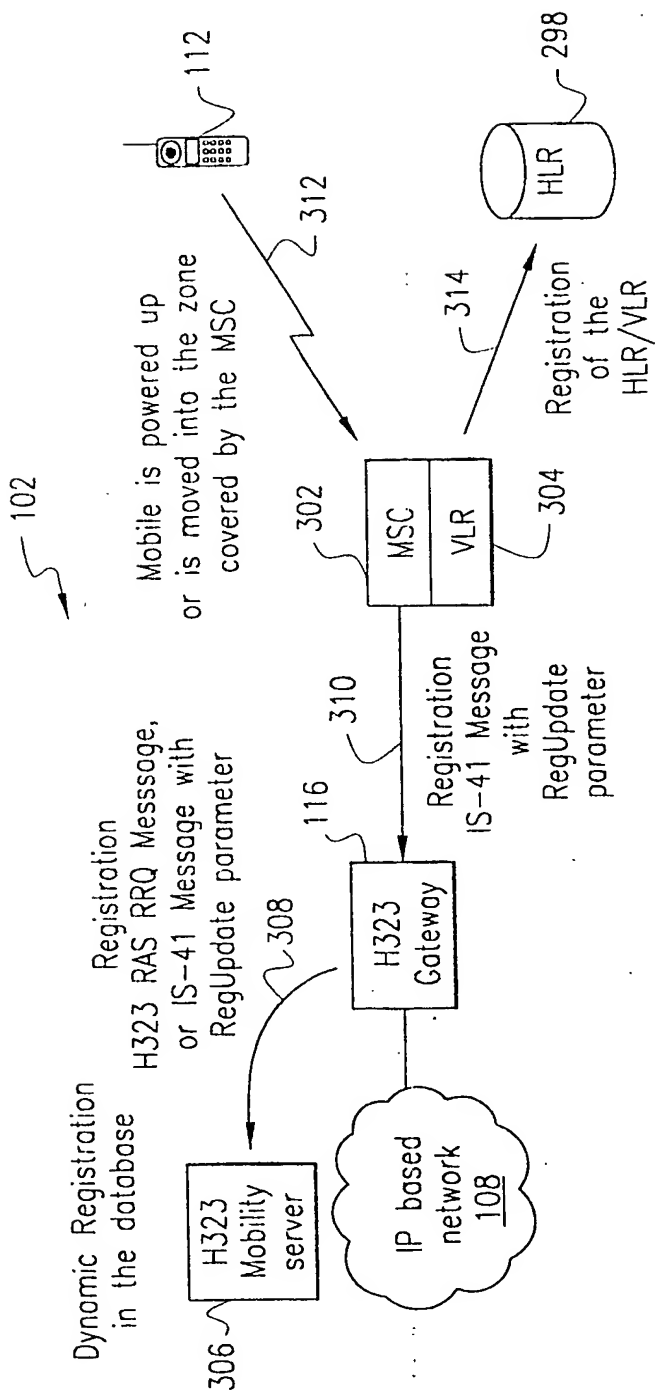


FIG. 1A

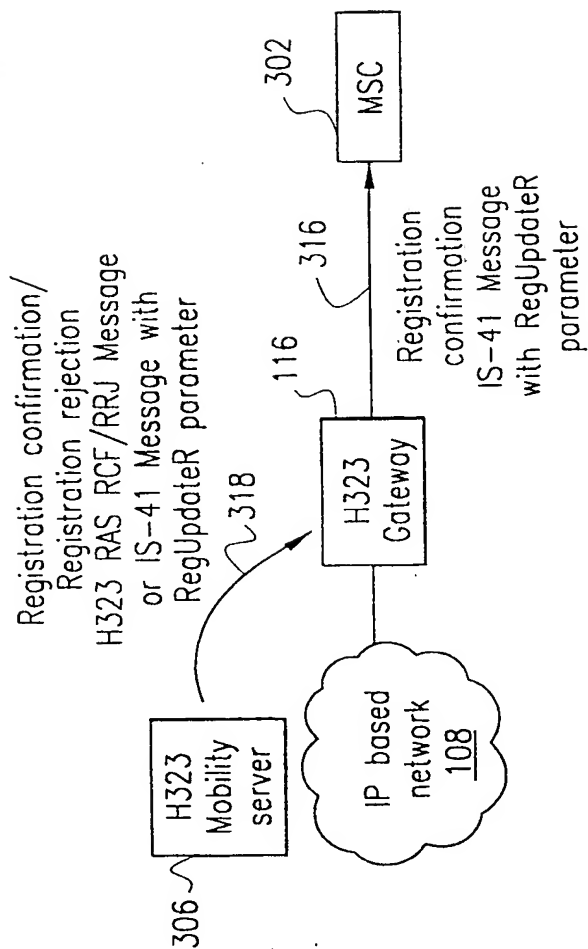


FIG. 1B

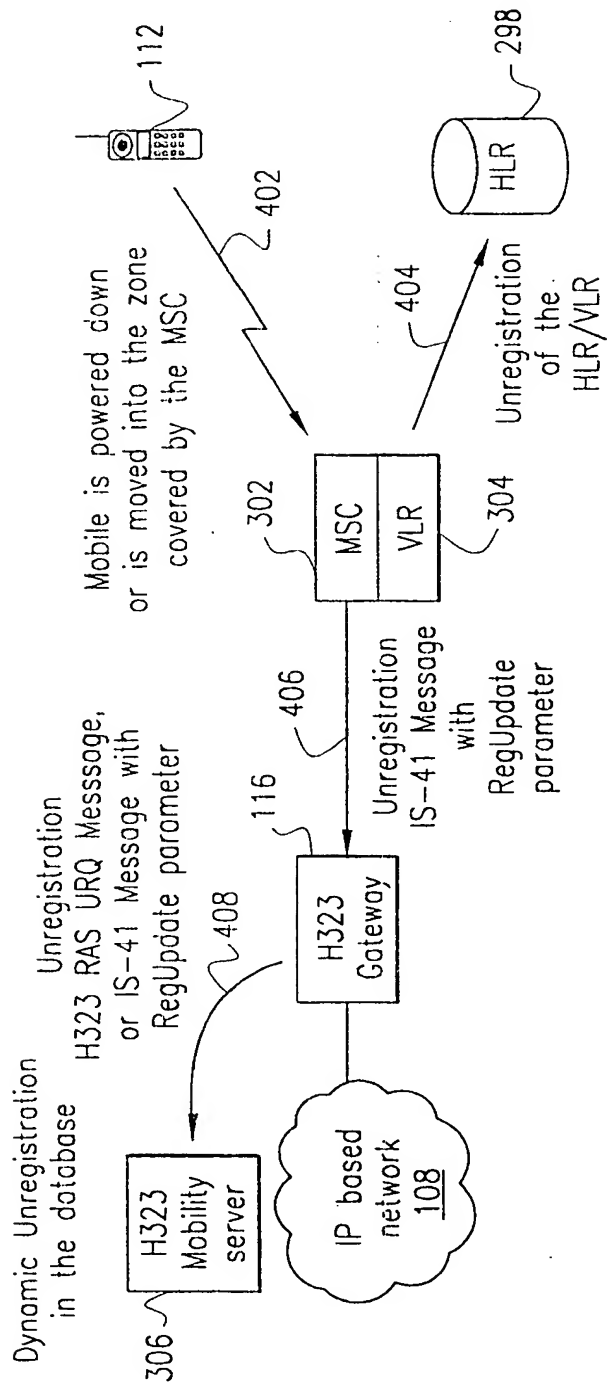


FIG. 2A

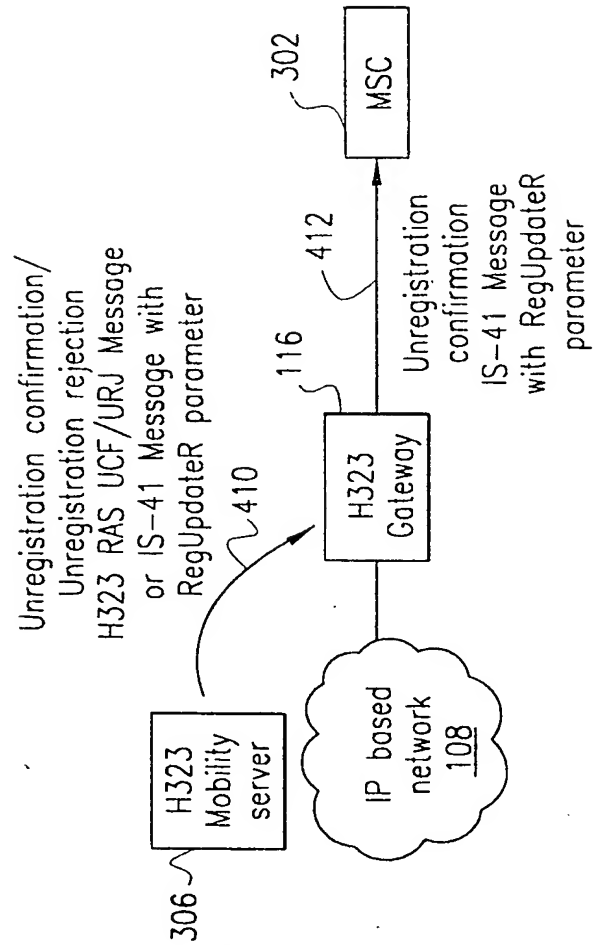


FIG. 2B

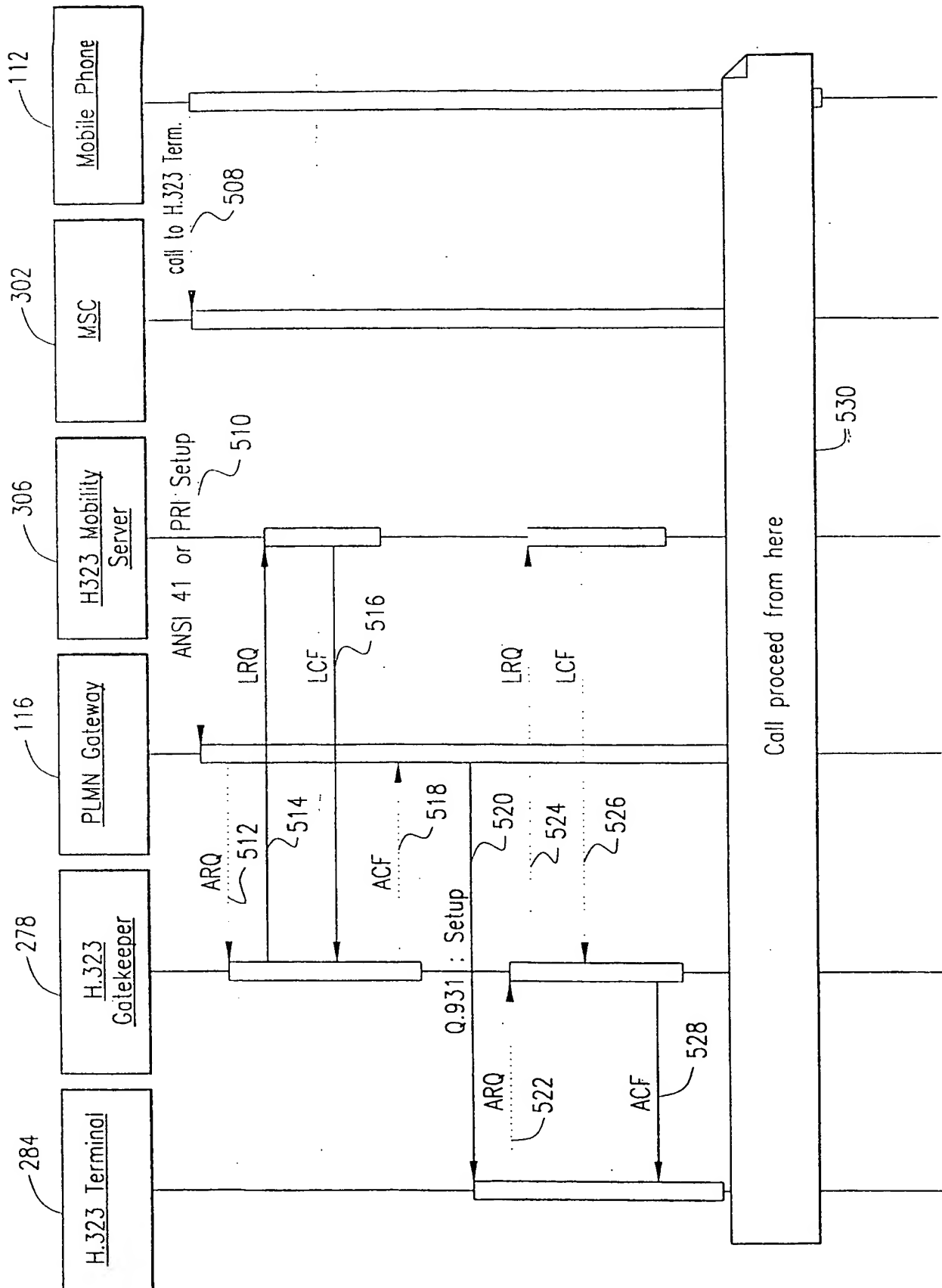


FIG. 3

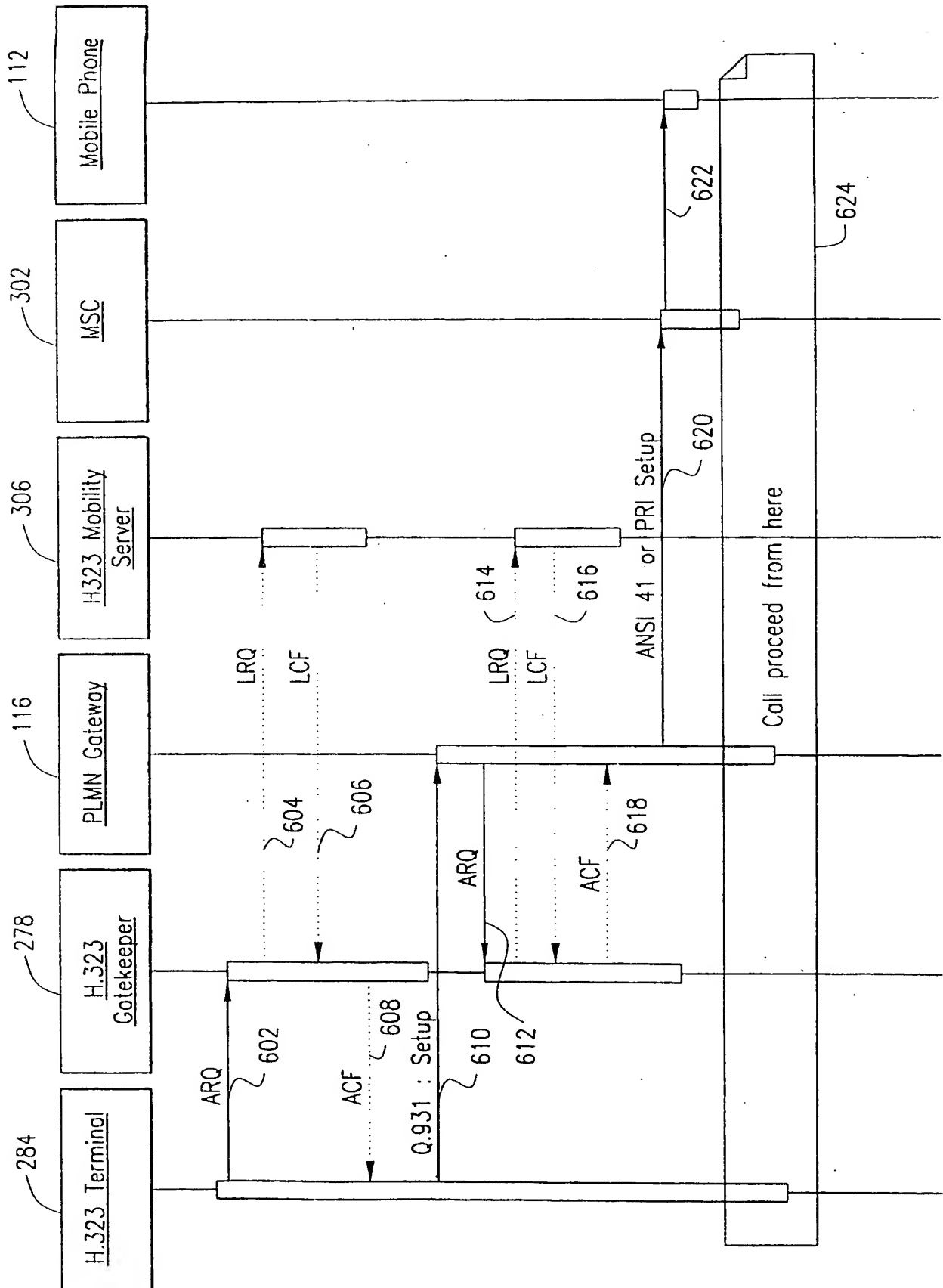


FIG. 4



## INTERNATIONAL SEARCH REPORT

Intern. Application No.

PCT/SE 99/02165

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 H04L12/66 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04L H04Q H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

☐ Electronic data base consulted during the international search (name of data base and, where practical, search terms used)**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 793 762 A (PENNERS JOHN HENRY HUBERT ET AL) 11 August 1998 (1998-08-11) abstract column 9, line 41 - column 10, line 6 column 11, line 3 - line 25 claim 1; figure 1	1
X	WO 95 28063 A (NOKIA TELECOMMUNICATIONS OY ; JOKIAHO TIMO (FI); RAJALA JUSSI (FI);) 19 October 1995 (1995-10-19) abstract	13, 17-21, 25, 26
A	column 5, line 9 - line 31  column 8, line 23 - line 33 claims 1, 11; figure 1  -/-	1, 7-12, 27

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

29 March 2000

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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